

tions are not very strong. The embryo has then increased in size, both the intestines and the œsophagus have become longer and thicker, whilst the greater part of the vitelline mass has disappeared. We can discover no more new organs after this period; the remainder of the vitellus entirely disappears, and the embryo shrivels greatly, becomes deformed, and dies. Thus when 2 eggs united, a new organ, the heart, made its appearance, although without developing itself perfectly. We have also seen 3 eggs cooperate: the same phænomena were presented, the only difference being that the organs were more strongly developed, so that the heart became more muscular, and the intestines longer; but as the vitelline mass was exhausted before any other organs made their appearance, the embryo began to shrivel, and died. (See Pl. XVII. figs. 13-17.)

[To be continued.]

XXVII.—*A Revision of the Genera of some of the Families of Conchifera or Bivalve Shells.* Part III. Arcadæ. By JOHN EDWARD GRAY, Ph.D., F.R.S., F.L.S. &c.

[Continued from vol. xiii. p. 418.]

Fam. ARCADÆ, Gray, Ann. & Mag. N. H. xiii. 417.

Tribe I. ARCAINA.

THE hinge of the more typical form of this family consists of two oblong or linear teeth in each valve, one placed on each side of the line directly under the umbo of the shell. These teeth are divided transversely into cross-ridges, alternating and interlocking with the cross-ridges of the teeth of the opposite valve.

The teeth may be compared to the lateral teeth of *Spisula* in *Mastradæ* and *Meretrix* in *Veneridæ*, and more especially to the teeth of the genus *Trigonia*; only in this family, instead of the teeth being grooved on the sides, the grooves are sufficiently deep to divide the teeth into transverse interlocking plates.

The separation of what has been usually regarded as a continuous series of teeth into groups, each forming a distinct tooth, like the teeth of *Trigonia*, has been overlooked by conchologists, though it was noticed by me in the 'Synopsis of the British Museum,' in 1840, p. 143, thus: "The hinges of the valve consist of a number of transverse interlocking teeth, which appear to be formed by the subdivision of two elongated lateral teeth."

The space which separates these two teeth or groups of plates

is always to be distinctly seen under the apex of the umbo, even in those species of *Arca*, like *A. Noæ*, which have a linear series of numerous nearly uniform plates.

In most species the two teeth or groups of cross-plates are of nearly uniform size and disposition; but in some the anterior tooth is very small, as in the genus *Argina*, and in the allied genus *Lunarca* the small anterior tooth is entire, and not divided into cross-plates; in *Litharca* the hinder tooth is entirely wanting, the anterior tooth being like that of the true *Arca*.

The ligament is external, covering the area or *talus* between the umbones, formed by the gradual thickening of the cardinal edges, which causes the umbones to separate further and further from each other as the shell enlarges. The cartilage is situated in a series of small pits on the outer edge of the hinge-margin, these pits being moved forward as the shell increases in size, leaving grooves diverging from the apex of the umbo towards the margin of the shell; the grooves on the two valves forming a circumscribing series of concentric lozenge-shaped areas on the *talus*. In some genera, as *Senilia*, the grooves are complete and close together; in others, as the true *Arca*, the grooves of the young shell are complete; but as the shell increases in size, the grooves very often do not reach to the umbo, but look like a pair of lines regularly diverging from the hinge-margin.

In the first and second sections the cartilage in the very young shell forms a single triangular spot on the hinge-margin, just in a line with the umbo. As the shell increases in size and the hinge-margin extends, the cartilage divides in the centre, the separate parts gradually diverge from each other as the hinge-line extends, shelly matter being deposited between the parts, and a new piece of cartilage is deposited in the place where the other was formerly situated; at length this separates in half, like the former; and as the shell reaches mature age, there is a succession of angular lines placed concentrically one within the other, formed by the successive cartilage-pits, the youngest and smallest being in the centre.

In the first section, where the *talus* is large, by the rapidity of the enlargement of the hinge-margin, the cartilage-pits and grooves are far apart; and in the second, where the *talus* or area is smaller and less developed, they are nearer together and more evenly concentric. The grooves formed by the cartilage-pits are to be seen on the surface of the *talus* in the fossil species.

In some of the species of the third section the cartilage appears to occupy the whole length of the cardinal margin, and each new portion of cartilage and ligament deposited on the hinge-margin is rather longer than the one formerly deposited, so as to fit itself to the extended length of the hinge-margin.

There is no appearance of the angular lines found in the former section, and the cartilage or ligament, when it dries, splits into longitudinal filaments extended from one umbo to the other.

I. *The hinge-line linear, straight; the teeth divided into numerous, small, nearly equal-sized, transverse crests; the umbones separated by a broad lozenge-shaped area, with a series of distant grooves regularly diverging from the hinge-margin towards the umbo; margin of the shell entire, often gaping below. Periostraca paleaceous.*

1. *Litharca*, Gray, Syn. B. M. 1840, 155; 1844, 81. Shell wedge-shaped, closed beneath, obliquely truncated behind, elongated and rounded in front; umbo posterior; hinder hinge-tooth absent; anterior hinge-tooth very long, linear, divided into many equal plates; margin smooth. Periostraca paleaceous.

L. Lithodomus = Byssoarca L., Sow.

Not having the animal, there is some difficulty in respect to the natural position of this shell. I have here regarded the short truncated end as the posterior, because I think I can observe the large oblong scar of the hinder pedal muscle under the inner margin of the truncated portion.

2. *Arca*, Gray, l. c. 155 = *Byssoarca*, Swainson. Shell oblong, subquadrate, gaping beneath; hinge-margin rather produced at each end; umbo subanterior, curved; front cardinal tooth moderate, divided into small equal crests like the hinder one; the scar of the hinder pedal muscle very large, oblong, triangular, on the hinder half of the dorsal surface of the cavity of the shell. Periostraca paleaceous.

a. *Teeth small.* *Arca* Noæ, *A. pacifica*, *A. truncata*, *A. navicularis*, *A. angulata*—if these presumed species are more than local varieties.

b. *Teeth larger.* *A. zebra*.

II. *The hinge-line broad, more or less curved; the teeth wider at the distal ends; the crest of the inner portion small, transverse, of the distal portion larger and more or less oblique or longitudinal; the umbones more or less separated by an elongate area, marked with angular concentric cartilage-grooves, or small, with slight cross-lines.*

A. *Shell radiately striated or nearly smooth; lower margin entire or subdentate, sometimes gaping; cardinal teeth subequal; the umbonal area marked with angular concentric cartilage-grooves.*

3. *Trisis*, Oken; Gray, Syn. B. M. 1840, 155. Shell sub-

quadrangular, subequivalve, twisted; the left valve largest and more twisted, with the hinder slope more or less keeled; margin smooth or subcrenate; cardinal area narrow, grooved; cardinal teeth gradually broader at the distal end, and divided into large oblique plates. Periostraca paleaceous, brown.

* *Hinder slope of left valve keeled.* T. tortuosa.

** *Hinder slope of left valve rounded.* T. semitorta.

4. *Barbatia*, Gray, Syn. B. M. 1840, 155. Shell oblong, longitudinal or subquadrate, equivalve; umbo subcentral; cardinal area narrow, angularly concentrically grooved; cardinal teeth curved, at the outer end dilated and divided into broad, more or less oblique or subconic plates. Periostraca paleaceous, with more or less elongate, hair-like, or foliaceous projections.

a. *Periostraca thick, with elongate hair-like lobes in the radiating grooves, with a furrow along their upper edge; shell brown, solid.* B. fusca (Australian), B. barbata (Mediterranean).

b. *Periostraca thin, with slender hair-like filaments in the radiating grooves; shell thin, white.* B. parva.

c. *Periostraca paleaceous, brown, with broad, flat, foliaceous lobes on the edge; shell thick, white.*

B. Helblingii = A. decussata = A. velata.

B. obliquata = A. Sinensis, B. fasciata.

B. lactea, B. raridentata, B. tenebrica.

B. glacialis.

d. *Periostraca thin* —; *shell white, cancellately ribbed or costated; hinder slope subcarinate.* Acar. B. reticulata, B. divaricata, B. gradata.

e. *Periostraca thin, smooth, with a series of triangular fan-shaped appendages in the radiating grooves; shell white; hinder slope strongly keeled; front and hinder margin dentated.* Calloarça. B. alternata.

The plates into which the cardinal teeth are divided differ considerably in specimens of the same species, not only in size and number, but also in form and direction; this is particularly the case with the specimens of *B. glacialis* from the Arctic Ocean, a species so distinct in form, substance, periostraca, and habitat, that there can be no difficulty in regarding all the varieties as belonging to the same species; yet it presents such variations in the form and character of the teeth, that one might be led, from only one or two specimens, to separate them into different subgenera. For in some the laminae of the outer end

of the cardinal teeth are transverse, like the inner ones; in others they are nearly longitudinal, like the teeth of *Cucullæa*; and in others again this part of the tooth is only divided into some irregular tubercles, or nearly obliterated.

I have observed the same variation, but not to such an extent, in other species; so that the form of the teeth does not afford generic nor even good specific characters.

5. *Cucullæa*, Lamk. Shell ventricose, subquadrate, subequilateral, equivalve, radiately striated; hinder slope subangular; margin entire, closed beneath; cardinal area narrow; the cardinal teeth dilated and bent down at the outer end, and divided into a few large longitudinal plates. The scar of the hinder adductor muscle on an elevated plate. Periostraca furfuraceous.

The cardinal area is smooth when the ligament and cartilage are removed, and the ligament appears smooth, but in some specimens I have observed two or three angular grooves.

Cucullæa concamerata = *C. auriculifera*, Lamk. = *A. cucullus*, Gmelin.

6. *Scaphula*, Benson (*Scaphura*, Gray, misprint). Shell thin, smooth, elongate, subcylindrical, equivalve, inequilateral; hinder slope elongate, slightly keeled; margin entire, closed; cardinal area narrow; hinge-teeth narrow, enlarged at the outer end, and divided into a few broad, oblique, nearly longitudinal laminae. Periostraca thin, smooth.

Freshwater rivers of India.

Scaphula Celox, Bens., *S. Pinna*, Bens.

B. Shell radiately costated; lower margin strongly dentated, interlocking; the ligament and cartilage occupying the whole area, smooth or transversely striated.

A. Shell oblong, equivalve, subquadrate; cardinal teeth subequal.

7. *Senilia*, Gray, Syn. B. M. 1840, 155; 1844, 81 & 92. Shell very thick, subcordate, ovate, equilateral, equivalve, strongly radiately ribbed; cardinal area rather broad, with concentric grooves; margins closed, very broadly folded; hinge-teeth large, oblong, nearly similar, divided into large, rugose, irregular cross-plates. Periostraca thin, hard, olive, polished.

Living in brackish waters of Africa.

The teeth and the plates into which they are divided are very variable in shape, size, and disposition.

S. senilis.

8. *Anadara*, Gray, Proc. Zool. Soc. 1847, 198. Shell thick, subcordate-ovate or subquadrate, subequilateral, equivalved,

strongly radiately ribbed; margin closed, broadly folded; hinge-area broad, concentrically grooved or smooth; hinge-teeth oblong, dilated, and with the plates more or less oblique at the outer ends. Periostraca olive, smooth or paleaceous.

: Marine, or in brackish water.

a. *Periostraca* thick, black, smooth; hinge-area grooved. *A. grandis*.

b. *Periostraca* thick, brown, velvety; hinge-area smooth.

A. holosericea. Hinder end produced.

A. multicostata, *A. globosa*. Hinder end square.

A. reversa. Hinder slope flattened.

c. *Periostraca* thick, brown, velvet-like, with a series of cylindrical bristles in the radiating grooves; hinge-area smooth. *Cara*.

* Shell produced behind; hinge-margin short. *A. Scapha* = *A. obliqua*, *A. maculosa*.

** Shell broad, notched behind; hinge-margin produced. *A. auriculata* = *avicularoides*.

d. *Periostraca* thick, brown, foliaceous, with broad lobes on the edge. *Rasia*. *A. formosa*, *A. secticostata*, *A. Deshayesii*, *A. trapezia* = *lobata*, *A. antiquata*, *A. radiata*, *A. inflata*.

e. *Periostraca* thick, or moderately thin, smooth, brown; ribs of shell nodulose. *A. tuberculosa*, *A. granosa*, *A. Corbicula* = *cuneata*.

9. *Scapharca*, Gray, Proc. Zool. Soc. 1847. Shell ovate or oblong, subquadrangular, subequilateral, inequivalved, strongly costate; margin closed, strongly plaited; left valve rather the largest, with the hinder part of the lower margin produced and receiving the edge of the right valve within it, and marked with deeper plaits; hinge-area narrow; teeth subequal, dilated, and with the plate of the outer ends more or less oblique or longitudinal.

a. Shell subcordate. *S. cepoides*, *S. incongrua* = *rhomboidea* = *Brasiliana* = *ovata* = *rufescens* = *inæquivalvis*, *S. cornea* = *anomala*.

b. Shell oblong-elongate. *S. Japonica* = *gubernaculum*.

c. Shell subquadrate. *S. pertusa*.

B. Shell trigonal, truncated behind; hinder hinge-tooth small, curved, anterior very long, linear.

10. *Noetia*, Gray, Syn. B. M. 1840, 155; 1844, 92. Shell

trigonal, ventricose, inequilateral, equivalve, strongly costated; hinder slope keeled; margin closed, strongly folded; umbo acute; cardinal area narrow, smooth; the anterior hinge-tooth elongated, divided into many subequal plates; the hinder tooth ovate, arched, small, of a few irregular laminae. Periostraca dark, foliaceous.

1. *Noetia triangularis*, n. s.

c. *Shell subcordate, inequivalve; anterior cardinal tooth very small.*

11. *Argina*, Gray, Syn. B. M. 1840, 155; 1844, 81 & 91. Shell subglobose, subcordate, subequivalve, inequilateral, strongly radiately costate; umbo subanterior; lunule none; left valve rather the largest, with the hinder part of the lower margin dilated and more deeply folded; hinge-area narrow, smooth; hinder cardinal tooth elongated, curved, the central crest small. Periostraca brown, foliaceous, with flat conical laminae in the radiating grooves.

a. *Shell subglobose.* A. *pexata*.

b. *Shell oblong, elongated.* A. *Campechensis* = A. *Americana* = *transversa* = *compacta*, A. *pectinoides*, *King* = *labiata*, A. *brevifrons*.

12. *Lunarca*, Gray, Syn. B. M. 1844, 81. Shell globose, subcordiform, radiately costated, nearly equivalve; umbo subanterior; lunule distinct, compresso-cordate; the lower hinder margin of the left valve rather the most deeply dentated; hinder cardinal tooth elongate, narrow in the middle, rather wider at each end; the front tooth of the left valve ovate, elevated, entire, fitting into a cavity in the inner edge of the front margin of the right valve.

It is possible that this may be only a monstrosity of *Argina pexata*, as I have observed that the teeth, especially the small anterior one, of this species are very apt to vary; but I have not seen any bearing a strong resemblance to the specimen on which this genus was founded; therefore I have retained it until we receive more specimens to elucidate the subject.

L. costata.

Tribe 2. PECTUNCULINA, Gray, Ann. & Mag. N. H. xiii. 417.

I. *The hinge-facet with a broad triangular impression occupied by the ligament, and with the cartilage in angular concentric grooves.*

13. *Axinea* = *Pectunculus*, Lamk. Shell suborbicular, rounded

or rather angularly produced behind; margin crenulated. Periostraca velvety.

- a. *Shell smooth, ventricose; hinder slope rather angular.* *A. violascens.*
- b. *Shell smooth, rounded behind; periostraca velvety.* *A. pilosa,*
A. Glycimeris.
- c. *Shell smooth, rather angularly produced behind.* *A. penna-*
ceus, A. angulatus, A. longior, A. obliquus.
- d. *Shell subcostate, rather angularly produced behind.* *A. radiatus.*
- e. *Shell subcostate, short behind.* *A. ovatus, A. laticostatus.*
- f. *Shell radiately ribbed, slightly truncate behind.* *A. pectini-*
formis.
- g. *Shell irregularly ribbed and radiately striate.* *A. inæqualis.*

II. *Cardinal area small, with a smaller triangular central impression for the cartilage (like the cartilage-pit of Lima) just under the umbo and above the division between the teeth.*

14. *Limopsis.* Shell circular, compressed, solid, radiately striate. Periostraca —? *L. multistriatus.*

15. *Limæa.* Shell ovate, obliquely produced behind. Periostraca hairy. *L. pygmæa = Limæa Sarsii,* Lovén. *L. —?* (Belcher).

The fossil *Limæa scalaris*, of Barton Cliff, is somewhat intermediate in form between these two genera.

XXVIII.—*On a New Species of Macgillivrayia.* By ARTHUR ADAMS, S.R.N., F.L.S. &c.

To the Editors of the Annals of Natural History.

On the Line, January 7, 1857.

GENTLEMEN,

I have the pleasure of sending you a notice of a new *Macgillivrayia*, the same species alluded to in p. 89, vol. ii. of the 'Genera of Recent Mollusca,' but there erroneously referred to the genus *Calcarella*. Associated with my *M. echinata* were examples of *Brownia*, another small genus of pelagian Mollusks, first named by D'Orbigny, and called afterwards *Echinospira* by Krohn, *Calcarella* by Souleyet, and *Jasonilla* by Macdonald, the animal of which was not observed. An example, likewise, of a